

WHAT IS CLAIMED IS:

1. A system for performing a data synchronization procedure, comprising:
a demultiplexer configured to recover elementary bitstreams, and to
5 extract decode timestamps and output timestamps
corresponding to said elementary bitstreams;
one or more decoders configured to decode said elementary bitstreams
to produce decoded frames;
an input controller configured to control said one or more decoders
10 according to said decode timestamps;
one or more output modules configured to process said decoded frames
to produce processed frames; and
an output controller configured to control said one or more output
modules according to said output timestamps, said output
15 controller performing an output timing resynchronization
procedure to align output frame timings of said processed frames
according to said output timestamps.
2. The system of claim 1 wherein said data synchronization procedure is
20 performed by a receiver device that receives a multiplexed bitstream from a
data source and responsively generates said processed frames to one or more
destination devices.
3. The system of claim 2 wherein said one or more elementary bitstreams
25 include a video bitstream and an audio bitstream, said one or more decoders
including a video decoder and an audio decoder, said one or more output
modules including a video output module and an audio output module.
4. The system of claim 3 wherein said input controller and said output
30 controller are decoupled to operate independently, and wherein said receiver
handles said video bitstream and said audio bitstream independently by
utilizing a plurality of different timebases.

5. The system of claim 3 wherein said output timing resynchronization procedure is performed after receiving new output timestamps as a result of at least one of a program change event, a bitstream discontinuity, and a powerup initialization event.

6. The system of claim 3 wherein said video decoder accesses said video bitstream from a video decoder buffer and stores decoded video frames into a video output buffer, said video output module accessing said decoded video frames from said video output buffer, said audio decoder accessing said audio bitstream from an audio decoder buffer and storing decoded audio frames into an audio output buffer, said audio output module accessing said decoded audio frames from said audio output buffer.

7. The system of claim 3 wherein said demultiplexer separates a composite bitstream into said elementary bitstreams, said decode timestamps including video decode timestamps and audio decode timestamps, said output timestamps including video output timestamps and audio output timestamps.

8. The system of claim 7 wherein said input controller instructs said video decoder to generate a decoded video frame when a corresponding one of said video decode timestamps equals a receiver system time clock, said input controller also instructing said audio decoder to generate a decoded audio frame when a corresponding one of said audio decode timestamps equals a receiver system time clock.

9. The system of claim 8 wherein said output controller instructs said video output module to output a processed video frame when a corresponding one of said video output timestamps equals a receiver system time clock, said output controller also instructing said audio output module to output a
5 processed audio frame when a corresponding one of said audio output timestamps equals a receiver system time clock.

10. The system of claim 9 wherein said receiver device generates a series of decoded video frames, said receiver device also generating a series of decoded
10 audio frames, said receiver device subsequently outputting a series of processed video frames corresponding to said decoded video frames, said receiver device also subsequently outputting a series of processed audio frames corresponding to said decoded audio frames.

11. The system of claim 3 wherein a system user instructs said receiver device to select a new program, said receiver device responsively performing a program search procedure to locate said new program.

12. The system of claim 11 wherein said demultiplexer separates a
20 composite bitstream into said elementary bitstreams, said decode timestamps including new decode timestamps, said output timestamps including new output timestamps.

13. The system of claim 12 wherein said input controller instructs said one
25 or more decoders to generate one of said decoded frames when a corresponding one of said new decode timestamps equals a receiver system time clock.

14. The system of claim 13 wherein said one or more decoders store said
30 one of said decoded frames into a buffer memory for said one or more output modules to access.

15. The system of claim 14 wherein said receiver device generates a series of decoded frames, said receiver device subsequently outputting a series of processed frames corresponding to said decoded frames.

5 16. The system of claim 14 wherein said output controller determines whether said output frame timings of said processed frames are aligned with said new output timestamps.

10 17. The system of claim 16 wherein said output controller performs said output timing resynchronization procedure to align said output frame timings of said processed frames with said new output timestamps.

15 18. The system of claim 17 wherein said output controller instructs said one or more output modules to sequentially output one of said processed frames when a corresponding one of said new output timestamps equals a receiver system time clock.

20 19. The system of claim 18 wherein said receiver device outputs a series of processed frames corresponding to said decoded frames.

25 20. The system of claim 10 wherein said receiver device outputs said series of processed video frames to a video display device, said receiver device also outputting said series of processed audio frames to an audio reproduction system.

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21. A method for performing a data synchronization procedure, comprising the steps of:

recovering elementary bitstreams with a demultiplexer that also

extracts decode timestamps and output timestamps

corresponding to said elementary bitstreams;

decoding said elementary bitstreams with one or more decoders to produce decoded frames;

controlling said one or more decoders according to said decode timestamps by utilizing an input controller;

processing said decoded frames with one or more output modules to produce processed frames; and

controlling said one or more output modules according to said output timestamps by utilizing an output controller that performs an output timing resynchronization procedure to align output frame timings of said processed frames according to said output timestamps.

22. The method of claim 21 wherein said data synchronization procedure is performed by a receiver device that receives a multiplexed bitstream from a data source and responsively generates said processed frames to one or more destination devices.

23. The method of claim 22 wherein said one or more elementary bitstreams include a video bitstream and an audio bitstream, said one or more decoders including a video decoder and an audio decoder, said one or more output modules including a video output module and an audio output module.

24. The method of claim 23 wherein said input controller and said output controller are decoupled to operate independently, and wherein said receiver handles said video bitstream and said audio bitstream by independently utilizing a plurality of different timebases.

25. The method of claim 23 wherein said output timing resynchronization procedure is performed after receiving new output timestamps as a result of at least one of a program change event, a bitstream discontinuity, and a powerup initialization event.

26. The method of claim 23 wherein said video decoder accesses said video bitstream from a video decoder buffer and stores decoded video frames into a video output buffer, said video output module accessing said decoded video frames from said video output buffer, said audio decoder accessing said audio bitstream from an audio decoder buffer and storing decoded audio frames into an audio output buffer, said audio output module accessing said decoded audio frames from said audio output buffer.

27. The method of claim 23 wherein said demultiplexer separates a composite bitstream into said elementary bitstreams, said decode timestamps including video decode timestamps and audio decode timestamps, said output timestamps including video output timestamps and audio output timestamps.

28. The method of claim 27 wherein said input controller instructs said video decoder to generate a decoded video frame when a corresponding one of said video decode timestamps equals a receiver system time clock, said input controller also instructing said audio decoder to generate a decoded audio frame when a corresponding one of said audio decode timestamps equals a receiver system time clock.

29. The method of claim 28 wherein said output controller instructs said video output module to output a processed video frame when a corresponding one of said video output timestamps equals a receiver system time clock, said output controller also instructing said audio output module to output a
5 processed audio frame when a corresponding one of said audio output timestamps equals a receiver system time clock.

30. The method of claim 29 wherein said receiver device generates a series of decoded video frames, said receiver device also generating a series of
10 decoded audio frames, said receiver device subsequently outputting a series of processed video frames corresponding to said decoded video frames, said receiver device also subsequently outputting a series of processed audio frames corresponding to said decoded audio frames.

31. The method of claim 23 wherein a system user instructs said receiver device to select a new program, said receiver device responsively performing a program search procedure to locate said new program.

32. The method of claim 31 wherein said demultiplexer separates a
20 composite bitstream into said elementary bitstreams, said decode timestamps including new decode timestamps, said output timestamps including new output timestamps.

33. The method of claim 32 wherein said input controller instructs said one
25 or more decoders to generate one of said decoded frames when a corresponding one of said new decode timestamps equals a receiver system time clock.

34. The method of claim 33 wherein said one or more decoders store said
30 one of said decoded frames into a buffer memory for said one or more output modules to access.

35. The method of claim 34 wherein said receiver device generates a series of decoded frames, said receiver device subsequently outputting a series of processed frames corresponding to said decoded frames.

5 36. The method of claim 34 wherein said output controller determines whether said output frame timings of said processed frames are aligned with said new output timestamps.

10 37. The method of claim 36 wherein said output controller performs said output timing resynchronization procedure to align said output frame timings of said processed frames with said new output timestamps.

15 38. The method of claim 37 wherein said output controller instructs said one or more output modules to sequentially output one of said processed frames when a corresponding one of said new output timestamps equals a receiver system time clock.

20 39. The method of claim 38 wherein said receiver device outputs a series of processed frames corresponding to said decoded frames.

25 40. The method of claim 30 wherein said receiver device outputs said series of processed video frames to a video display device, said receiver device also outputting said series of processed audio frames to an audio reproduction system.

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41. A computer-readable medium comprising program instructions for performing a data synchronization procedure by performing the steps of:
recovering elementary bitstreams with a demultiplexer that also
extracts decode timestamps and output timestamps
corresponding to said elementary bitstreams;
decoding said elementary bitstreams with one or more decoders to
produce decoded frames;
controlling said one or more decoders according to said decode
timestamps by utilizing an input controller;
processing said decoded frames with one or more output modules to
produce processed frames; and
controlling said one or more output modules according to said output
timestamps by utilizing an output controller that performs an
output timing resynchronization procedure to align output frame
timings of said processed frames according to said output
timestamps.

42. A system for performing a data synchronization procedure, comprising:
means for recovering elementary bitstreams, and extracting decode
timestamps and output timestamps corresponding to said
elementary bitstreams;
means for decoding said elementary bitstreams to produce decoded
frames;
means for controlling said means for decoding according to said decode
timestamps;
means for processing said decoded frames to produce processed
frames;
means for controlling said means for processing according to said
output timestamps; and
means for performing an output timing resynchronization procedure to
align output frame timings of said processed frames according to
said output timestamps.

43. A system for performing a data synchronization procedure, comprising:
one or more decoders configured to decode elementary bitstreams to
produce decoded frames according to decode timestamps;
5 one or more output modules configured to process said decoded frames
to produce processed frames according to output timestamps;
and
and output controller configured to perform an output timing
resynchronization procedure to align output frame timings of
10 said processed frames according to said output timestamps.